



CHART PROGRAM

CHART WEB R3.5

DETAILED DESIGN

Version 1.0
Work Order 14 Deliverable 11
Doc# WO14-CHARTWeb-RD-002

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Prepared by: **CSRA**

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Revision History

Date	Version	Description	Page Affected	Author
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1 INTRODUCTION

1.1 Purpose and Scope

1.1.1 Purpose

This document describes the design of the software for CHARTWeb Release 3.5. The CHARTWeb Release 3.5 release provides the features listed below. These features are being developed under work order WO 14.

CWEB-708 Remove old JW Player 7.10.2 files and directories

The JW Player 7.10.2 COTS products previously installed on CHARTWeb folder needs to be removed and all references used on the video.php file to stream live traffic video needs to be replaced with VideoJS.

CWEB-660 Replace JW Player 7.10.2 with VideoJS

The JW Player 7.10.2 COTS products used to stream live traffic video needs to be replaced with VideoJS.

1.1.2 Scope

The main objective of this detailed design document is to provide software developers with a framework in which to implement the requirements identified in the CHARTWeb Release 3.5 Requirements document. A matrix mapping requirements to the design is presented in Appendix A (Mapping to Requirements).

1.2 Project Executive Summary

The main objective of this detailed design document is to provide software developers with a framework in which to implement the requirements identified in the CHARTWeb Release 3.5 Requirements document. The overall contents of CHARTWeb Release 3.5 are summarized in Section 1.1.1.

1.2.1 Design Process

This release focused on re-implementing existing capabilities using a new COTS product so the design process was not applicable.

1.2.2 Design Tools

This is not applicable for the current release, as there are no applicable design diagrams.

1.2.3 Work Products

The final CHARTWeb Release 3.5 design consists of the following work products:

- Human-Machine Interface section which provides descriptions of the screens that are changing or being added in order to allow the user to perform the described uses.
- **N/A for R3.5:** UML Class diagrams, showing the software objects which allow the system to accommodate the uses of the system described in the Use Case diagrams
- **N/A for R3.5:** UML Sequence diagrams showing how the classes interact to accomplish major functions of the system
- Requirement Verification Traceability Matrix that shows how this design meets the documented requirements and use-cases for this feature

1.2.4 System Overview

The CHARTWeb application consists of the CHARTWeb public internet web site, sometimes referred to as CHARTWeb Desktop. This application resides in the CHART DMZ and provides data to the public via the web. CHARTWeb Desktop delivers data to audiences using standard desktop web browsers as well as mobile device browsers.

The CHARTWeb Desktop application resides on the DMZCHARTWEB server in the CHART DMZ. This server runs on Windows Server 2008R2 and utilizes PHP 5.6.2, .NET Framework 4.5, ASP 3.0, CSS, JavaScript/JQuery and HTML 5. For information that is displayed on the CHARTWeb Desktop internet map, data is retrieved by direct JavaScript calls to the CHART Data Exporter which also resides in the CHART DMZ on the CHARTEXP2 server. Data for HTML, XML and RSS output is retrieved via JavaScript calls to the CHART Data Exporter as well as direct database queries through a firewall to the CHARTWeb Public database which resides on the inside of the MDOT network.

The data sets shared by CHARTWeb include:

- Traffic Cameras – Provides the ability to view live, streaming traffic video feeds.
- Maryland Highway and Traffic Information where the public can view reported traffic incidents, weather road closures, active construction and maintenance closures information.
- Planned Lane Closures where the public can view planned lane closures in Maryland.
- Route Restrictions where the public can view a list of Maryland State Route Restrictions
- Local Weather Station Data where the public can view current weather data from CHART System Weather Stations.
- Speed Sensor Data where the public can view current traffic speeds from CHART system Speed Sensors.
- Highway Message Signs where the public can view current highway advisory messages from CHART dynamic message signs.
- Snow Emergency Plans where the public can view the list of Maryland counties in a declared state of snow emergency.

- Weather Related Road Conditions provides the travel conditions for interstate, primary and secondary routes.RSS and XML Feeds where the public can view and subscribe to CHARTWeb RSS and XML data feeds.
- Current weather conditions including current temperatures, local forecasts and tropical weather.
- Interactive Map which provides a Google Map based user interface displaying location and data for incidents, speed sensors, road closures, traffic video cameras, dynamic message signs, route restrictions, highway advisory radio and area wide conditions.

Figure 1-1 provides an overall CHART systems architecture. Figure 1-2 provides an overall CHARTWeb architecture.

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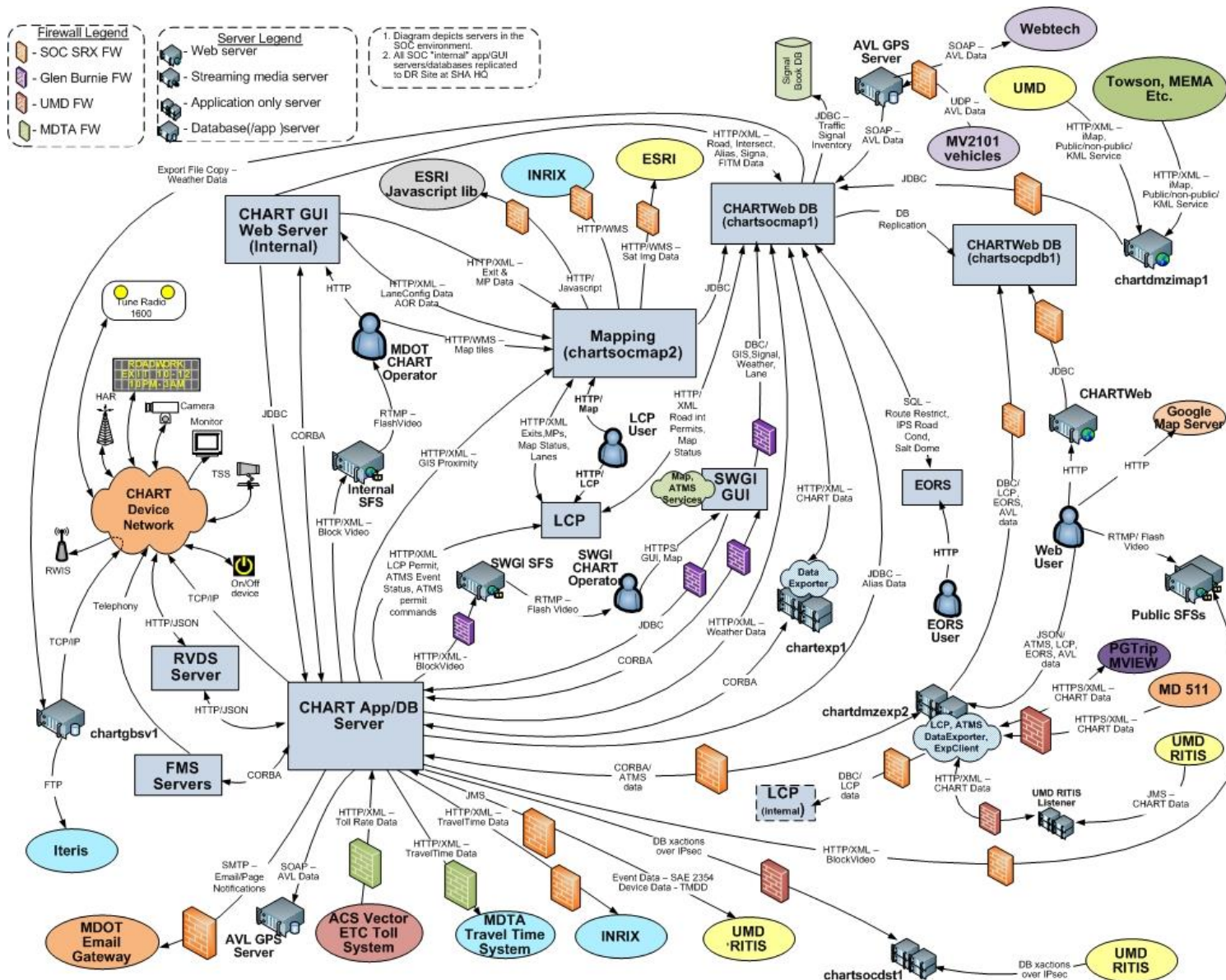


Figure 1-1. CHART and External Interfaces

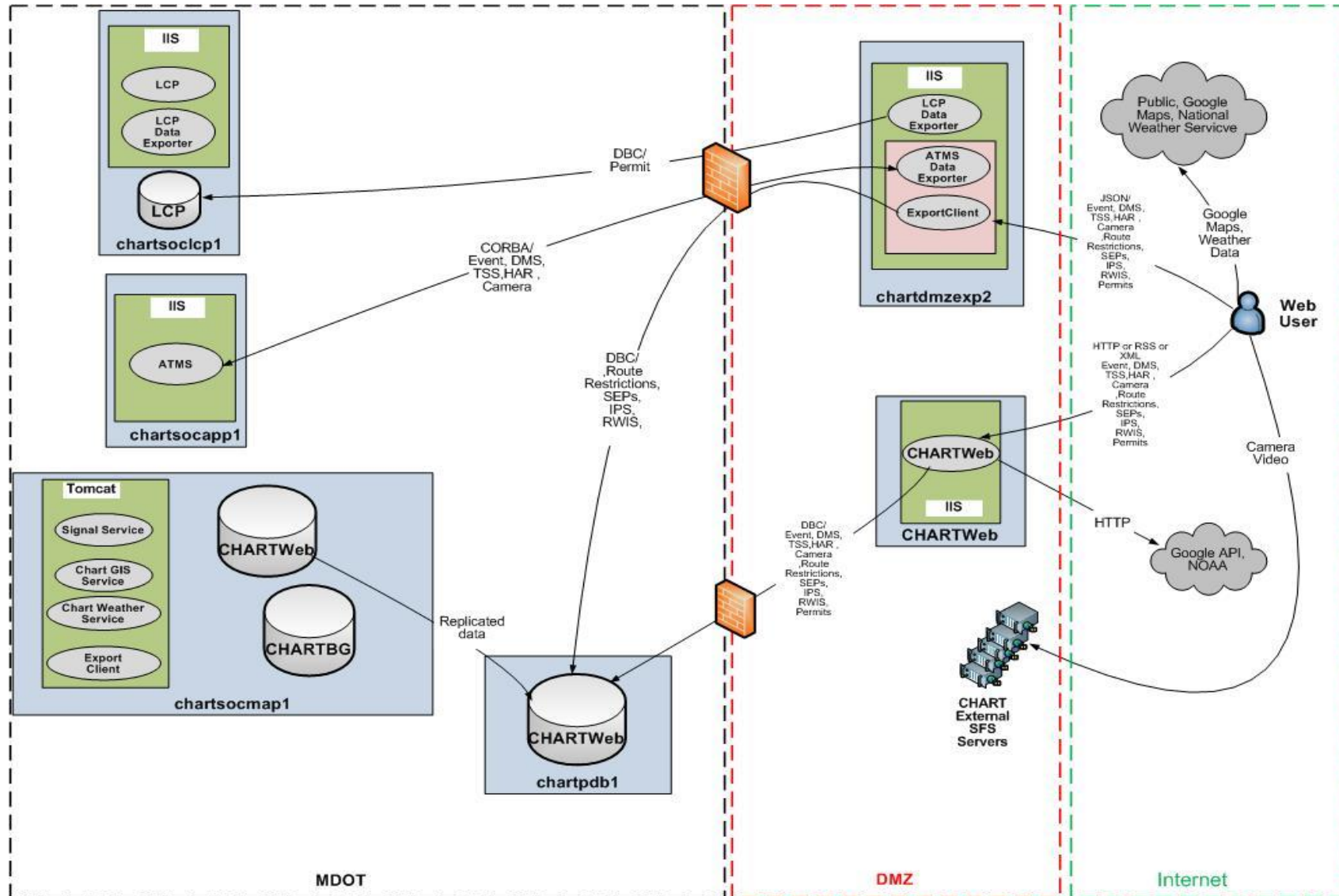


Figure 1-2. CHARTWeb Detailed Architecture

A matrix mapping requirements to the design is presented in Appendix A (Mapping to Requirements).

1.2.5 Design Constraints

No design constraints have been identified for R3.5.

1.2.6 Future Contingencies

No future contingencies have been identified for R3.5.

1.3 Document Organization

Section 1 of this document is the introduction.

Section 2 describes the system architecture.

Section 3 describes the file and database design.

Section 4 describes the human –machine interface

Section 5 describes the detailed design with additional detailed content (detailed diagrams)

Section 6 describes the interfaces external to ATMS.

Section 7 describes the system integrity controls.

1.4 Points of Contact

The key members of the staff are listed below:

CSRA Operations Manager: Sam Jallad (410-872-2120)

CSRA Program Manager: Laura Nicholas (678-861-6569)

CSRA Release Manager: Gary Krebs (678-838-9935)

System Administrator: Kenny Gross (410-582-5680)

Application Delivery Manager: Chris Brennan (410-872-2124)

CHARTWeb Development Lead: Paul Mink (410-582-5684)

Database Administrator: Nick Posteraro (410-872-2125)

Configuration Manager: Delena McFadden-Mello (410-872-2122)

Configuration Manager: Mike Fleming (410-872-2127)

System Test: Asha Khatri (410-872-2130)

CHART Project Manager: Dale Lineweaver (410-582-5695)

CHART Program Administrator: Rick Dye (410-582-5619)

1.5 Project References

The following are the list of the relevant CHARTWeb R3.5 documents. Note that not all are updated for these specific releases:

1. *CHART Program WO 14 CHARTWeb R3.5 Software Requirements*, July 7, 2017, WO14-CWEB-RD-001-V1.0

1.6 Glossary

TERM	DESCRIPTION
AJAX	Asynchronous Javascript and XML (or JSON)
AOR	Area of Responsibility representing an area that a person, user, operations center, etc. is responsible for
API	Application Programming Interface
ATMS	Advance Traffic Management System
CHART	Coordinated Highways Action Response Team
CORBA	Common Object Request Broker Architecture
CCTV	Closed Circuit Television
COTS	Commercial Off The Shelf [software or equipment]
CRUD	Create, Read, Update, and Delete (the four standard actions which can be performed on a database table)
DBMS	Database Management System
DMS	Dynamic Message Sign, an electronic sign used to display information to the traveling public
DTMF	Dual Tone Multi-Frequency (touchtone telephone signaling system)
Dynamic Message Sign	An electronic sign used to provide messages to motorists
ERD	Entity Relationship Diagram used to show the relationship between tables in an RDBMS
FMS	Field Management System
Functional Right	A user right, granted to CHART users via Roles. Each operation on a device, including the ability to configure a device, view its sensitive information, and issue commands to the device are controlled by user rights. Users must possess the proper right to be able to perform these actions.
GB	Gigabytes
GIF	Graphic Interchange Format (picture file)
GIS	A Geographic Information System (GIS) is any system that captures, stores, analyzes, manages, and presents data that are linked to location
GUI	Graphical User Interface
HAR	Highway Advisory Radio, a radio station used to broadcast programmable messages to motorists and other travelers regarding traffic and other delays
HTML	HyperText Markup Language
HTTP	HyperText Transfer Protocol
IDL	Interface Definition Language, which describes CORBA interfaces
JAXB	Java API for XML Binding
JDBC	Java Database Connectivity
JDOM	Java Document Object Model
JNI	Java Native Interface, a means of interfacing Java programs with languages written in other languages, such as C++
JRE	Java Runtime Environment
JSON	JavaScript Object Notation
JTS	Java Topology Suite
KB	Kilobytes
LCP	Lane Closure Permit, a permit for the closure of a road for maintenance, or the system used to manage those permits

TERM	DESCRIPTION
MB	Megabytes
MSSQL	Microsoft SQL [Server], the DBMS used in CHART
NSIS	Nullsoft Scriptable Installation System
PDF	Portable Document Format
PR	Problem Report
RDBMS	Relational DBMS
REST	Representational State Transfer
RPC	Remote Procedure Call
RV	Recreational Vehicle
RVDS	Remote Video Display Solution
SDK	Software Development Kit
SFS	Streaming Flash Server
SHA	State Highway Administration
SNMP	Simple Network Management Protocol
SOC	Statewide Operations Center
SQL	Structured Query Language
TSS	Traffic Sensor System
UCD	Use Case Diagram. Depicts a collection of Use Cases.
UML	Unified Modeling Language
XML	Extensible Markup Language
VSD	Video Streaming Device, part of the RVDS
VSS	Video Streamer Service, part of the RVDS

2 SYSTEM ARCHITECTURE

The sections below discuss specific elements of the architecture and software components that are created, changed, or used in CHARTWeb Release 3.5.

2.1 System Hardware Architecture

There are no changes to the system hardware architecture for CHARTWeb Release 3.5.

2.2 System Software Architecture

The CHARTWeb website presents a display of information and messages from internal SHA systems and divisions for public viewing including lane closures, highway incidents, video of select highway locations, and highway weather. The CHARTWeb Desktop website primarily serves users of desktop computers. The CHARTWeb website consumes data from the CHART Advanced Traffic Management System (ATMS), the Emergency Operations Reporting System (EORS), the Lance Closures Permit (LCP) system, and the Lufft system.

CHARTWeb consumes data CHART data using multiple mechanisms. CHARTWeb reads data from CHART application components via a database connection to the public CHART Mapping CHARTWeb database. CHARTWeb also consumes data via a connection to the CHART Export Client running in the DMZ. Note that the CHART Export Client exists in the DMZ for the purpose of feeding data to CHARTWeb so that component is critical to CHARTWeb. The Export Client has CORBA connections to the internal ATMS application server, database connections to the internal mapping database, an HTTP connection to the external CHART ATMS Data Exporter, and an HTTP connection to the LCP Data Exporter. Note also that the LCP Data Exporter itself is housed in the DMZ and has its own database connection to the internal LCP database server.

2.2.1 COTS Products

The COTS CI collects all COTS packages into a single CI for configuration control purposes. This CI is used to track the COTS packages and versions used. Rather than list each subsystem in paragraphs, the COTS packages used throughout the system are described in Table 8-2 below. Package redistributability is designated as Open source, Free (freely available, but without source), or Proprietary (purchased or otherwise restricted). Usage is listed as Development, Runtime, both Development and Runtime, or Administrative. For COTS that is both Development and Runtime, the predominant usage, if that makes sense, is listed first. Administrative usage is listed when the product is not required to build the system, even if the product is a key part of the development effort, such as Microsoft Visual Studio, which developers use extensively.

Table 8-2. COTS Packages

Product Name	Version	Description/Purpose	Redistributability	Usage
Microsoft SQL Server	2008 R2	CHARTWEB uses Microsoft SQL Server 2008 to host its databases.	Proprietary	Runtime
Microsoft Visual Studio (including .NET 4.5)	2013 Ultimate	CHARTWEB uses Microsoft Visual Studio 2012 Ultimate for C# source code development. Necessary library files are used in the runtime environment.	Proprietary	Development Runtime
Microsoft Windows	2008 Server	CHARTWEB uses Microsoft Windows 2008 Server as its standard runtime platform for the CHARTWEB application/database servers.	Proprietary	Runtime
RedGate SQL Backup Pro	6	CHARTWEB uses these parts of the RedGate DBA Bundle monitoring tools to support the backup and restore processes and to monitor database performance	Proprietary	Runtime
RedGate SQL Monitor	2.3.0			
Subversion	1.6	CHARTWEB uses Apache Subversion for source code control.	Open source	Development
Subversion browser TortoiseSVN	1.6.15	Official CHARTWEB builds use TortoiseSVN subversion browser. Some developers may use TortoiseSVN as well.	Open source	Development
vRanger Backup & Replication	5.3.1	The CHART Program uses vRanger Backup & Replication by Quest Software to maintain system backups. This subsystem is not part of the CHARTWEB per se, but serves in a support role. Therefore it is listed as having Administrative usage, rather than Runtime usage.	Proprietary	Administrative

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Product Name	Version	Description/Purpose	Redistributability	Usage
XML Spy	2009 Pro SP 1	CHARTWEB developers use XMLSpy to visualize, edit, and generate XML and XSLT used by the CHARTWEB and by some of the external systems which interface with the CHARTWEB.	Proprietary	Development

3 FILE AND DATABASE DESIGN

CHARTWeb stores most of its data in a MS SQL Server database. Some data is stored in flat files on the CHARTWeb server.

This section describes all of these types of data.

3.1 Database Management System Files

CHARTWeb Release 3.5 is tested and delivered with the fielded MS SQL Server version.

3.1.1.1 Overview

There are no database changes for Release 3.5.

3.1.1.2 Database Architecture

Except as noted, CHARTWeb Release 3.5 features do not impact the overall architecture of the CHARTWeb database.

4 HUMAN-MACHINE INTERFACE

4.1 CWEB-660: Replace JW Player 7.10.2 to VideoJS

This PR replaces JWPlayer 7.10.2. with VideoJS. The change should be mostly transparent to the user, except for the internal controls within the player, which are visually different than JW Player.

Context Menu

VideoJS is similar to JW Player in that right clicking on the video reveals a context menu. The content of the context menu varies from browser to browser. In Internet Explorer 10 and higher, the context menu can be used to verify which player product (e.g. VideoJS) is being used; and the videojs-swf Flash binary version is also displayed. (The VideoJS library version is not displayed, nor is the videojs-flash plugin library version). The “(CHART)” appended to the version indicates that the SWF is custom built for CHART (to support a configurable buffer time), as described in the Key Design Concepts section.



Figure 4-1 VideoJS Flash Pluggin Context Menu

Controls

Both VideoJS and JWPlayer have controls at the bottom of the window, appearing when the mouse cursor moves within the window and fading away after the cursor leaves or stops moving. The functionality of the controls is the same (both contain Pause, Volume, and Fullscreen controls), and each player pauses / resumes when the video itself is clicked on. The controls are a different visually however, as can be seen in the screenshots below.

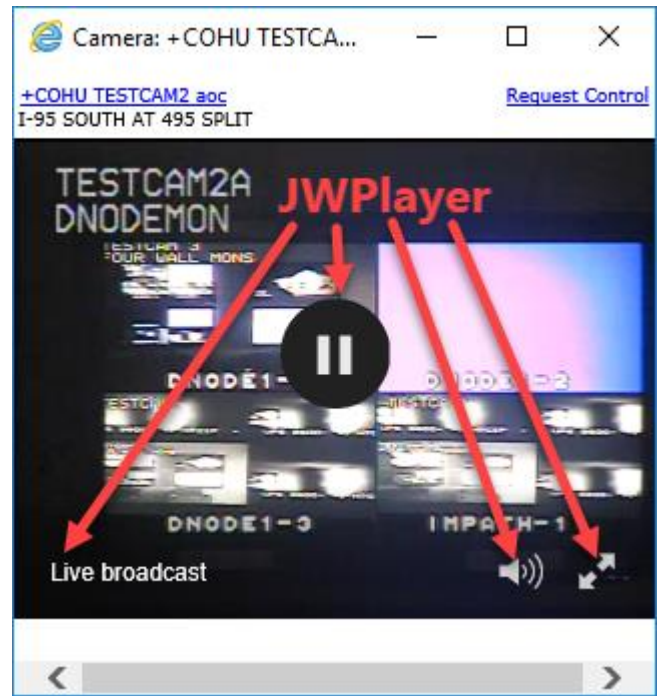


Figure 4-2 VideoJS vs. JWPlayer controls

Both players support fullscreen mode, and their controls remain mostly the same when in fullscreen mode. In Fullscreen mode, both players support returning to non-fullscreen by pressing the Escape key or clicking on the un-Fullscreen control at the bottom right.

Loading

There are also visual differences when initially loading the video, as shown below:

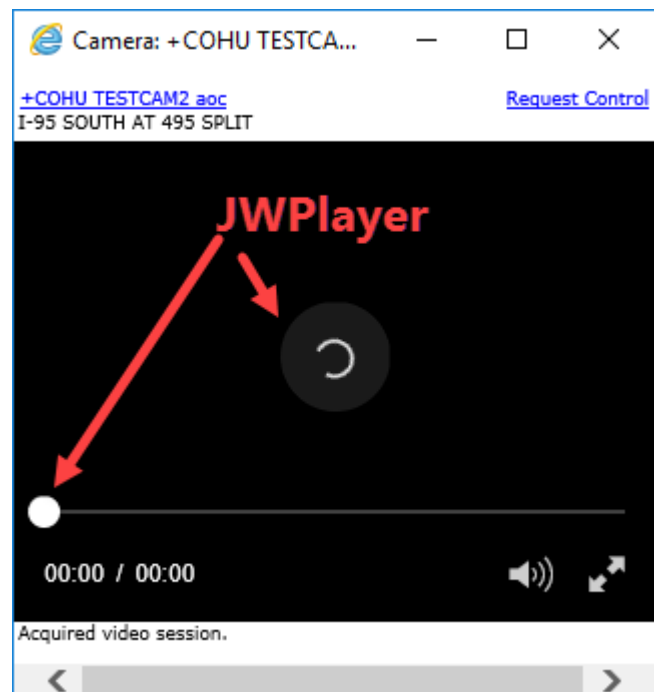
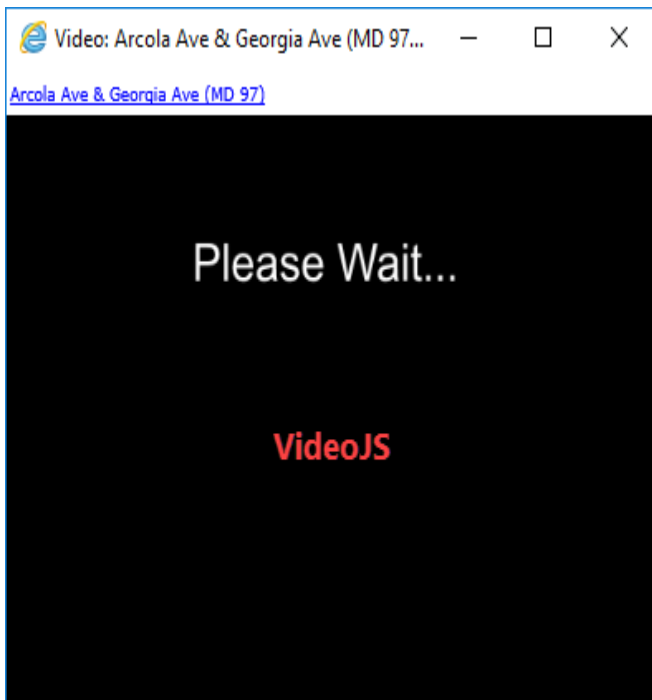


Figure 4-3 VideoJS vs. JWPlayer Loading

4.2 CWEB-708: Remove old JW Player 7.10.2 files and directories

This PR removes old JW Player 7.10.2 files and directories from the server. This change should not be transparent to the user.

5 DETAILED DESIGN

5.1 Hardware Detailed Design

There is no new hardware (servers, devices, etc.) deployed that is related to CHARTWeb R3.5.

5.2 Software Detailed Design

5.2.1 Key Design Concepts

This section describes key design concepts for CHARTWeb 3.5.

5.2.1.1 CWEB-708 Remove old JW Player 7.10.2 files and directories

The existing JW Player 7.10.2 folders, and files used by CHARTWeb application will be removed, and all references to the JW Player found in the video.php file will be deleted.

5.2.1.2 CWEB-660 Replace Video Player

The JW Player 7.10.2 COTS products used to stream live traffic video will be replaced by VideoJS. The reasons for this are:

1. Get rid of licensing costs associated with JWPlayer
2. Remove the “phone home” functionality that JWPlayer has where it makes calls across the Internet for licensing and to support Google Analytics.
3. Provide an upgrade path for the future to a non-Flash protocol (with the understanding that for now, RTMP protocol is needed for low latency video streams)

To perform this upgrade the VideoJS files and folders will be installed in the CHARTWeb directory under the \Webroot\video folder and the video.php file will be updated to use the VideoJS player.

6 EXTERNAL INTERFACES

This section describes the external interfaces utilized by CHARTWeb. There are no high-level interfaces being added or modified in Release 3.5 of CHARTWeb. See Figure 6-1.

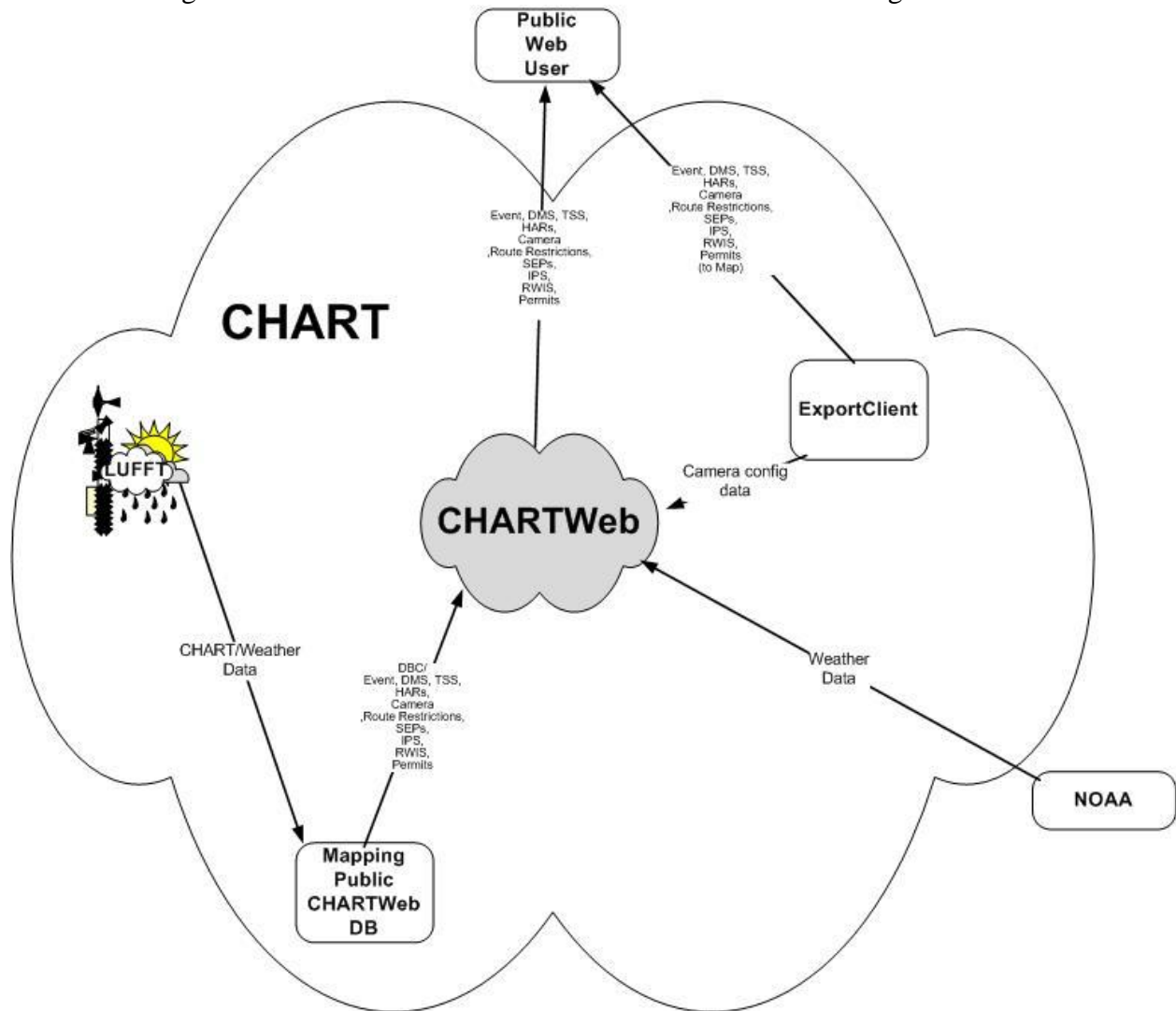


Figure 6-1. CHARTWeb and External Interfaces

6.1 Interface Architecture

For CHARTWeb R3.5, there are no changes to the interface architecture.

6.2 Interface Detailed Design

For CHARTWeb R3.5, there are no changes to the external interface designs.

7SYSTEM INTEGRITY CONTROLS

This section describes the security and integrity controls being added or modified in Release 3.5 of CHARTWeb. Features being added for CHARTWeb Release 3.5 do not change security aspects of the CHARTWeb.

Appendix A Mapping to Requirements

The table below shows how the new and modified requirements in the CHARTWeb R3.5 Requirements document map to elements contained in this design.

Table A-1. Mapping to Requirements

PR	Requirement	Other Design Elements (DD refers to a Section in this Design Document)
CWEB-660	UC-1 (see R3.5 Requirements)	Section 4.1
CWEB-708	UC-2 (see R3.5 Requirements)	Section 4.2